



FIELD INVESTIGATIONS OF UNCONTROLLED HAZARDOUS WASTE SITES

FIT PROJECT

**TASK REPORT TO THE
ENVIRONMENTAL PROTECTION AGENCY
CONTRACT NO. 68-01-6056**

**EMERGENCY PUMPOUT WELL
FOR REILLY TAR SITE
ST. LOUIS PARK, MINNESOTA**

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INTRODUCTION

A plan has been developed by FIT for an emergency gradient pumpout well and treatment system for the Drift-Platteville aquifer near the Reilly Tar site in St. Louis Park, Minnesota.

The Reilly Tar plant was involved with coal-tar distillation and wood-preservation operations between 1917 and 1972. As a result of these operations, groundwater contamination occurred. Contamination of the drift resulted from infiltration of spills and rainwater runoff, and seepage from wastewater disposal ponds and sludge disposal sites.

The geology of concern in this report includes the glacial drift and upper bedrock units. The glacial drift is stratigraphically complex. However, for the purposes of this report, it has been simplified. See the attached geologic column for further explanation.

The upper glacial drift is surficial material that is peat and muck in the lowland portions of the site area and alluvial sands and gravels on the higher ground. This unit varies in thickness from a few feet to 35 feet. A clay till unit underlies the upper glacial drift. The thickness of this unit varies from 2 to 5 feet. The middle drift unit consisting mainly of sands and gravels underlies the till. This unit varies in thickness from 15 to 48 feet and averages approximately 20 feet. The middle drift is underlain by the lower drift which is a complex sequence of silt, sand, and clay. The average thickness of the lower drift is approximately 20 feet, but it varies from 12 to 45 feet thick.

The upper bedrock in descending order consists of the Platteville limestone, the Glenwood shale, and the St. Peter sandstone. A buried bedrock valley east of the site has cut through the top two units. Thus, the St. Peter sandstone contacts the drift. The St. Peter sandstone aquifer is used by many area municipal and industrial wells.



Adopted from Sunde, Hydrogeologic Study
of the Republic Creosote Site (1974).

Most of the contaminants, toxic organic compounds, are located near the site in the glacial drift and the uppermost bedrock aquifer (Platteville). The toxic organic compounds include phenolics, some Polynuclear Aromatic Hydrocarbons (PAH's) such as naphthalene, pyrene, anthracene, phenanthrene, and dibenzofuran.

Polynuclear aromatic hydrocarbons (PAH's) also called polycyclic aromatic hydrocarbons, make up a large class of organic compounds containing two or more condensed rings. The simplest compound belonging to this class is naphthalene (moth balls). These compounds occur naturally in coffee, clove stems, eucalyptus oil, smoke from open burning and cigarettes, and petroleum derivatives such as found in the coal tar distillation and wood preserving site in St. Louis Park, Minnesota.

Since PAH's occur often and are known carcinogens or cocarcinogens, there is justifiable concern over their control. The relative carcinogenicity of PAH's as a class is second only to the aflatoxins. The particular structure of the various PAH's greatly influences the carcinogenicity of a particular PAH. The carcinogenicity varies from inactive (anthracene) to borderline (benz(a)anthracene) to highly carcinogenic (BP, 7,12 dimethyl benz(a)anthracene). Benzo(a)pyrene is one of the most common and hazardous of the PAH's. Anthracene, benzanthracene, and benzo(a)pyrene are found in the wells near the St. Louis Park site. Detectable concentrations of PAH's in the St. Louis Park municipal well water justifies concern for this problem.

DISCUSSION

Pumpout Well

The function of an emergency gradient pumpout well system is to control the gradient by collecting contaminated groundwater before it has the opportunity to migrate from the site area. Two flow routes from the contaminated area are (1) lateral movement through the middle drift aquifer and (2) vertically to the lower drift and Platteville aquifer and subsequently laterally through the Platteville. In this case, the critical area is the buried bedrock valley which is located approximately 4500 feet east of the site. In this area, the Glenwood Shale (confining layer beneath the Platteville) and the Platteville are absent. Therefore, a pathway to the St. Peter sandstone aquifer for contaminants is readily available.

In the subsurface, the coal tar exists in five forms: liquid (tarry material), emulsion, dissolved in water, adsorbed on soil material, and vapor. Immediately southeast of the site, the material is tarry liquid. Near monitoring well W-13, (see attached map) the liquid becomes emulsified with tarry liquid, emulsion, and dissolved liquid phases. Further east the liquid becomes dissolved.

Bacteria in the subsurface actively degrade the coal tar compounds. Aerobic growth affects low molecular weight compounds such as phenolics and naphthalene. This break down of the coal tar fluid may result in further contamination depending upon the final product(s) of the degradation and, by allowing the coal tar fluid to be mobilized in the groundwater. However, without this breakdown, the coal tar would never become an innocuous compound(s).

The emergency pumpout well(s) should be located downgradient from the source of contamination (southeast of the site) and west of the buried bedrock valley. The well should be located as near the center line of the contaminant plume as possible. Furthermore, the well location(s) will be restricted by physical barriers and land use. Potential locations include the area immediately south of Central Jr. High School and the western portion of the park, west of the water tower.

Recommended Emergency Pumpout
Well Location

NON-RESPONSIVE

Well Location

There are several reasons for favoring the above locations over one at or near the coal tar contaminant source. In-place treatment of the contaminants will occur in the soils by bacterial degradation and adsorption on the soil grains. By step pumping near or in the source, the problems involved with pump maintenance, due to the nature of the coal tar material, may make continuous pumping impossible. Furthermore, the difficulties and cost in treatment of this material at the surface would not be favorable for an emergency pumpout well location. A location west of the buried bedrock valley would control dissolved contaminants which have already migrated from the site, while more contaminants would "escape" to the buried bedrock valley if pumping would occur near the source. Pumping at the source may cause an increase of the available surface area which could come in contact with "clean water" entering the area from the north and west. Thus, dissolved contaminants in the aquifer may increase and at least create a short term increased contaminant problem.

There are two locations within the drift-Platteville aquifer which should be considered for pumping - the middle drift and the lower drift - Platteville. By pumping the middle drift aquifer, contaminants within this aquifer will flow to the well and the piezometric levels will be lowered. By lowering the piezometric levels, some flow within the lower drift - Platteville aquifer will flow up to a well set in the middle drift aquifer. To make the most efficient use of a well set in the middle drift, the well should fully penetrate the aquifer (i.e. the bottom of the well screen should be at the top of the lower drift). The anticipated depth is 40 to 50 feet.

Prior to placement of a well within the lower drift-Platteville aquifer, the fact that the water in the Platteville flows in the cracks and solution channels of this limestone formation must be evaluated. Any well set in the Platteville may not necessarily be able to produce sufficient water and control the water in the Platteville. The flow depends on the interconnection of the voids in the limestone. Therefore, prior to a decision of the use of a Platteville well as an emergency pumpout well, tests must be conducted on such a well. The anticipated depth of a lower drift Platteville well is 90 to 100 feet.

The pumpage rate of a middle drift aquifer well must consider the area affected by pumping as well as the amount of drawdown. The amount of drawdown must be considered due to potential problems with surface structure failures that may be caused by lowering of the water table.

Numerous assumptions were made as to the characteristics of the middle drift aquifer in order to obtain ballpark figures as to the pumpage rates. The following assumptions were made:

Hydraulic conductivity	10^{-2} cm/sec (28.8 ft/day)
Aquifer thickness	20 feet
Effective porosity	25%
Hydraulic gradient	0.0018
Transmissivity	576 ft ² /day

Based upon the above parameters, the suggested pumpage rate for the middle drift aquifer to 50 to 100 GPM.

Due to the variability of the lower drift-Platteville aquifer characteristics, no pumpage rates for this aquifer were projected. Upon receipt of results of point dilution and slug tests being performed by the USGS, more specific recommendations concerning the pumpage rate could be made.

The following recommendations should be implemented for an emergency gradient pumpout well system for the Drift-Platteville system.

1. An emergency pumpout well should be placed at the base of the middle drift aquifer (40 to 50 feet deep) and be screened the entire thickness of the aquifer. The well should be located on the west side of the park, west of the water tower (see attached map).
2. The pump and well should be capable of yielding 100 GPM.
3. Slug tests, grain size analysis, and point dilution studies should be performed on wells located in the Drift-Platteville.
4. A groundwater monitoring well should be placed adjacent to the middle drift aquifer pumpout well location and constructed so as to be used later as a pumpout well.
5. A pump test should be performed on this lower drift-Platteville well to test its effectiveness and need as a pumpout well to protect the buried bedrock valley.

These recommendations are based upon emergency status and should in no way be considered as a permanent solution to the Drift-Platteville aquifer clean-up problem.

Treatment of pumped groundwater

Since the characteristics of the groundwater in the middle drift aquifer at the proposed pumpout site are unknown, the necessity for or extent of treatment of the water which is pumped is not known. When the pump out well is installed, pump tests should be run to determine the characteristics of the groundwater. At that time the results of the sample analyses can be compared to whichever standards are deemed applicable to decide whether treatment is necessary. If treatment is necessary the sample analysis will be needed to design the treatment facility.

If treatment is necessary, the most likely treatment systems to be utilized will be oxidation of the organics or adsorption onto activated carbon. Both methods have been utilized in the past, there is a potential problem with oxidation if chlorine is used as the oxidant, chlorination of partially oxidized organics may occur, causing increased toxicity problems in the effluent. Activated carbon may turn out to be the method of choice because of its efficiency and the relatively low flow rate (50-100 gpm). Both methods should be tested by bench-scale studies on the actual groundwater.

It should be stated and understood that treatment of wastewater with the potential characteristics of PAH's which have to be removed to ppb's level will require state of the art technology for both the treatment method and analytical procedures. Treat wise, this area of removing organic constituents to the ppb range has not been tested or proven to your knowledge as of 1981.

After the installation of the pump out well, samples should be taken during a pump test. The samples should be analyzed for phenols and PAH's to determine whether treatment is necessary and where the pumped water will be discharged and what criteria will be applied to the discharge.

If treatment is necessary, bench-scale treatability studies should be conducted by an engineering firm to derive design criteria and recommend a treatment process.

An efficient and suitable treatment process can be implemented, as necessary, following the above outlined chain of events.

RB/df